KAJIMA

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Stadium Construction for the 2002 World Cup Soccer Games

UNWAVERING COMMITMENT TO ADVANCED ENGINEERING AND TOTAL SAFETY

Stadium Construction for the 2002 World Cup Soccer Games

The 1998 World Cup soccer games in France aroused great enthusiasm worldwide before their exciting conclusion on July 12. The next World Cup soccer games are scheduled to be held in Japan and Korea during 2002. Of the 64 scheduled matches, 32 are to be played at 10 stadiums in Japan, of which 8 are to be newly built. Kajima will be handling the construction of four of these stadiums, including a Saitama Prefecture–managed stadium that will have the largest seating capacity of any specialized soccer stadium in Asia.

Noteworthy among the other three stadiums that Kajima will be constructing is the Miyagi Prefecture Stadium, which is scheduled to be completed by March 2000. Occupying 36,684m^2 of a 146.1ha site, this stadium will have 57,564m^2 of total floor space and provide seating for about 50,000 spectators.

A uniquely designed roof—reminiscent of the helmet of Masamune Date, famous for his role in the history of Miyagi Prefecture and Japan as a whole—will cover the spectator stands.

The large roof covering the main seating area will be supported by arch pipe trusses measuring more than 300m that stretch from one end of the stadium to the other and T-shaped pipe truss beams mounted on the top of the stands. This unprecedented support structure will allow the creation of a roof with a slender curve that outlines a large horizontal hollow. Giant prestressed tied beams will be laid under the soccer pitch and pulled into a bow shape to withstand the reaction force of the arch trusses. Concrete abutments at each end of the stands will serve as pivots for the stress transmitted by these connecting beams and the arch trusses.

Kajima plans to use the panel vent construction method to erect the structural steelwork of the roof over the main seating area. Using this method, truss panel arrangements

Miyagi Prefecture Stadium

Location: Miyagi Prefecture

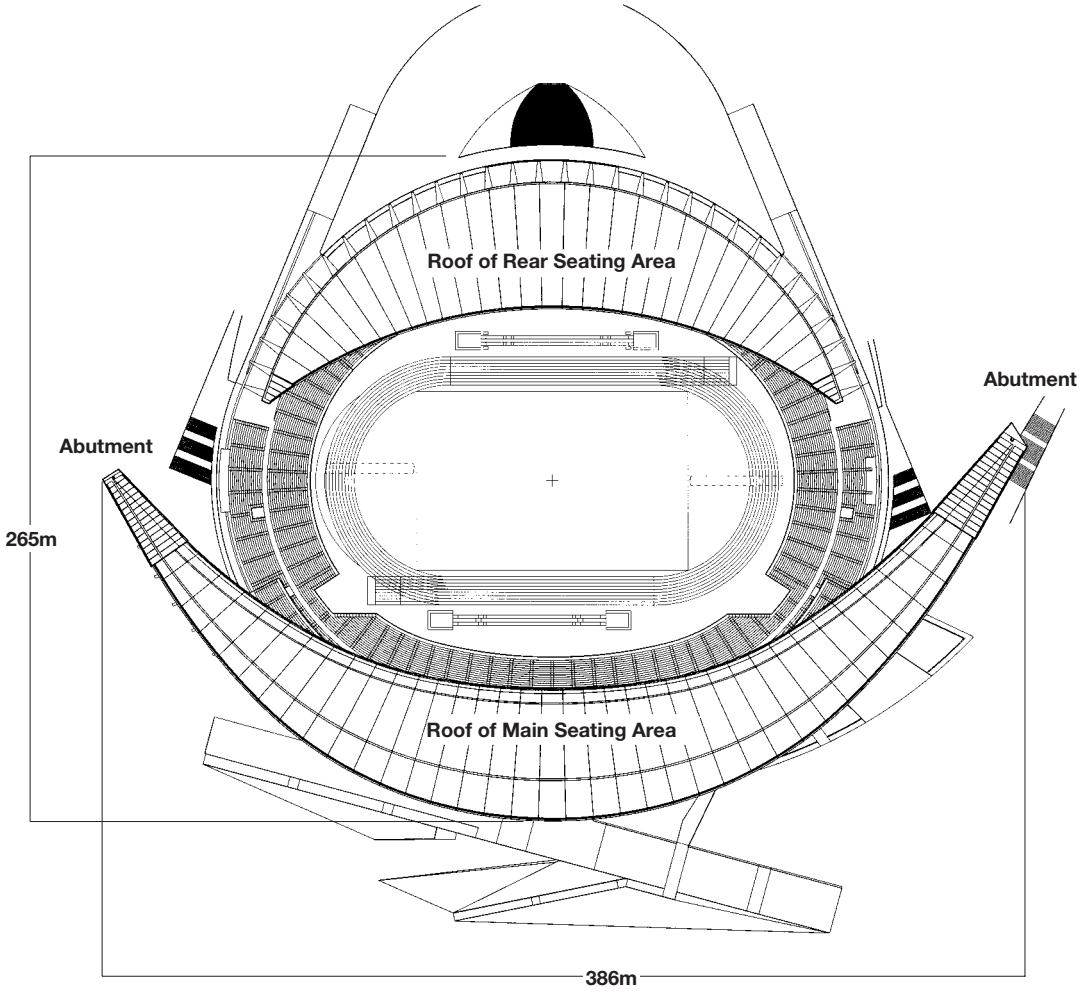
Customer: Miyagi Prefectural Government

Design and Supervision:
HARIU + ABE COOPERATIVE ATELIER

Structural Engineering:
KOZO KEIKAKU ENGINEERING

Description:
Site: 146.1ha; Site of structure: 36,684m^2; Total floor space: 57,564m^2; Stands: Steel reinforced concrete structure with a portion reinforced concrete; Roof: Steel structure, six stories above ground; Seating capacity: Approximately 50,000

Construction period:
October 1996 to March 2000



Concourse of the rear seating area

suspended by jacks are attached to a structure consisting of two special-purpose H-frame girders and then lifted into place by 750-ton cranes. The panel vent method is a safe, highly efficient construction method that is far simpler than the conventional vent construction method.

The roof over the rear seating area will be supported by pipe trusses in the form of cantilever beams mounted to the steel reinforced concrete concourse. It will protrude from both ends of the stands and reach a maximum height of 47m above the seats in the middle section. A pillar will be placed beneath the concourse to ensure the stability of the roof is maintained.

Kajima is advancing smoothly with work on the Miyagi Prefecture Stadium; the Prefectural Soccer Stadium in Saitama Prefecture, which will seat 63,060 people and may be used for the championship match; a stadium in Shizuoka Prefecture featuring a roof that covers all fixed seating sections and enables rainy-day matches to be watched in comfort; and a stadium in Niigata Prefecture with an exquisitely curved membrane-structure roof.

Location of Stadiums in Japan for the 2002 World Cup Soccer Games

Note: The larger dots represent projects being handled by Kajima.

Stadiums in Japan for the 2002 World Cup Soccer Games (Some stadium names are tentative.)

Location	Stadium Name	Owner	Capacity	Type	Completion
Sapporo	Sapporo Dome	Sapporo City	42,122	Multiuse	5/2001
Miyagi Prefecture	**Miyagi Prefecture Stadium**	**Miyagi Prefectural Government**	**49,281**	**Multiuse**	**3/2000**
Ibaraki Prefecture	Kashima Soccer Stadium	Ibaraki Prefectural Government	41,800	Specialized	Refurbishment
Saitama Prefecture	**Prefectural Soccer Stadium**	**Saitama Prefectural Government**	**63,060**	**Specialized**	**7/2001**
Yokohama	Yokohama International Comprehensive Sports Field	Yokohama City	70,336	Multiuse	---
Niigata Prefecture	**Prefectural Comprehensive Stadium**	**Niigata Prefectural Government**	**42,700**	**Multiuse**	**3/2001**
Shizuoka Prefecture	**Shizuoka Stadium ECOPA**	**Shizuoka Prefectural Government**	**50,600**	**Multiuse**	**3/2001**
Osaka	Choi Ground Sports Stadium	Osaka City	45,409	Multiuse	Refurbishment
Kobe	Gosaki Park Stadium	Kobe City	42,000	Specialized	10/2001
Oita Prefecture	Oita Stadium	Oita Prefectural Government	43,254	Multiuse	3/2001

Note: Projects in bold indicate Kajima construction projects.

Kajima around the World

From Japan

Kajima Teams Up with Jacobs Engineering Group Inc.

On August 25, 1998, Kajima and U.S.–based Jacobs Engineering Group Inc. signed a Memorandum of Understanding that is expected to upgrade Kajima's engineering proficiency and promote its business development in fields related to food processing, pharmaceuticals, and medical engineering. The partnership is particularly significant for Kajima in light of the recent introduction in Japan of such U.S. process management methods as validation for pharmaceutical manufacturing and Hazard Analysis Critical Control Point (HACCP) for food processing. For Jacobs, the Memorandum of Understanding is a major step toward expanding the company's operating network throughout Japan and other Asian regions.

Together, Kajima and Jacobs are offering design, engineering, and construction services related to food processing as well as pharmaceutical projects to Japan-based companies in the United States and to U.S.–based companies in Japan. The partners are also exchanging information and staff for joint R&D endeavors and project engineer training.

Headquartered in Pasadena, California, Jacobs is one of the largest engineering and construction firms in the United States, with 1997 revenues amounting to US$1.78 billion. The company's worldwide engineering activities include design, project and construction management, construction, and maintenance services.

Commercialization of the AIRS Environment-Friendly Refrigeration System

In cooperation with Nippatsu Corporation, Kanematsu Corporation, and Nishikawa Sangyo Co., Ltd., Kajima has developed and commercialized the Air Refrigerant System (AIRS). Since 1996, AIRS equipment has been installed for applications involving cooling, refrigeration, and freezing in several types of warehouses and food freezing units. Having proved the practicality of AIRS, Kajima has begun the full-scale marketing of the system.

The first system of its kind to be commercialized anywhere in the world, AIRS works by rapidly expanding ambient air to create low-temperature air that is used as a cooling medium. Accordingly, it does not use such chemical compounds as chlorofluorocarbons (CFCs),

which harm the ozone layer; ammonia, which is poisonous and explosive; or liquid antifreeze, which can pollute soil and water. AIRS is thus an extremely environment-friendly system that features superior safety during earthquakes and fires.

Each member of the development consortium is working actively to promote the utilization of AIRS, primarily in warehouses. The consortium is also investigating the feasibility of such distribution applications as refrigerated trucks, ships, and freight containers as well as other new applications related to health care, food processing, skating rinks, and bobsledding tracks.

From the United Kingdom

Kajima Taylor Woodrow Wins Bid for 120 Fleet Street Project

After a round of international bidding, Kajima Taylor Woodrow Ltd., a joint venture of Kajima U.K. Engineering Ltd. and Taylor Woodrow Construction Ltd., was awarded an £80 million order from a subsidiary of ITOCHU Corporation.

The project involves the design and construction of 57,000m^2 of floor space for offices and retail use in two basements as well as the shell and core of the nine upper floors. This includes retaining and refurbishing the Daily Express Building, which has historic architectural significance. This office building development project is one of the largest currently under way in the City of London. The site is in a district famous for its high concentration of financial firms, and the completed building will provide high-quality space for Goldman Sachs International as a tenant. Hurley Robertson & Associates will serve as the architect, while structural engineering and building services will be provided by Ove Arup & Partners.

The project team includes an equal number of members from each of the joint venture's parent companies. Both Kajima U.K. Engineering and Taylor Woodrow Construction expect to gain valuable expertise from working with their experienced partners and are considering extending the operations of Kajima Taylor Woodrow to include additional contracts in the future.

From Singapore

Order Received for Singapore's Cantonment Police Complex

Kajima Overseas Asia Pte. Ltd. has won a round of international bidding to receive a ¥14.5 billion order from Singapore's Public Works Department (PWD) for the construction of the Cantonment Police Complex near Singapore's central business district. Designed by the PWD, the sophisticated complex will consist of four buildings ranging from 6 to 25 stories above ground and 4 stories below ground that interconnect the buildings. Construction began in June 1998 and is scheduled to be completed in December 2000.

From Ghana

Expansion of Medical Research Facility in Ghana

Kajima has received an order from Ghana's education ministry for the expansion of the Noguchi Memorial Medical Research Center (NMMRC).

The original NMMRC facility was built on the grounds of Ghana University in 1978, using a grant from the Japan International Cooperation Agency (JICA), to commemorate the successful yellow-fever-related research conducted by Dr. Hideyo Noguchi. One of West Africa's principal medical research centers, the NMMRC has conducted considerable research related to yellow fever, malaria, and diarrhea. In recent years, the center has placed increasing emphasis on research related to AIDS and tuberculosis, and the current expansion project is aimed at equipping the center with a biohazard research facility.

The expansion project is funded with a JICA grant of ¥2.8 billion, which is the value of the contract received by Kajima. The biohazard research facility will be a two-story reinforced concrete structure with 888m^2 of total floor space. Plans call for the construction work to be completed by March 1999.

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